RESEARCH ARTICLE

A Comparative Analysis of Absolute Grading and Relative Grading of Academic Performance of Learners

R. V. Mahendra Gowda, N. Viswanathan

Mahendra Engineering College (Autonomous), Mallasamudram,
Tamilnadu – 637 503, India

ABSTRACT: Upon critical analysis and exploratory research it is observed that there is a significant difference between the Absolute Grading system and the Relative Grading system being introduced recently in autonomous engineering institutions. It is found that Relative Grading implemented in its present form using some software has resulted in significant reduction in the GPA of students. The reduction in Subject-wise GPA or Class-average GPA in a semester varies from 0.09 to 0.73 with an average loss of 0.42. So if similar differences are considered over a period of 8 semesters of Engineering degree, then the reduction in GPA/CGPA will range from 0.4 to 1.0, which is a huge loss to certain percentage of students. Especially, more number of average and below average students who used to score relatively lower range of marks are bound to receive relatively lower grades and hence they may end up with securing lower GPA/CGPA. Hence the authors, after thorough analysis and research, proposed a suitable Relative Grading system through normalization and computing $\mu \pm \sigma$ limits for adopting suitable class intervals of marks to allot appropriate grades. This approach minimizes the difference between the relative grades received by students as compared to those received by following the Absolute Grading system. It is further observed that there is a strong linear relationship between Grade Point and Marks.

KEYWORDS: Absolute Grading, Assessment, Examination, Relative Grading, Normal distribution

https://doi.org/10.29294/IJASE.9.1.2022.2617-2636 **©2022 Mahendrapublications.com, All rights reserved**

1. INTRODUCTION

Education is a complex multi-stage process of building character through acquiring knowledge, skills, ethics and wisdom to lead a happy human life. The Outcome of Education is the Learning by Student / Graduate. It also refers to the Graduate Attributes in terms of Knowledge, Skill and Attitude (Behaviour) of Engineering Graduate(s). Our traditional education system largely focused on knowledge and the outcome was measured in terms of the Marks scored by each learner in a test/examination. Accordingly the learners are classified in ascending/descending order based upon the marks secured by each individual. Though a student who secured few marks higher than the other is perceived to be better but there is always some similarity between them in terms of their skill/capability, attitude or team work.

The globalization of higher education has necessitated a certain level of uniform standard in the engineering education system. The adaptation to Outcome-Based Education (OBE) throughout the world and a greater focus on Higher-Order Thinking Skills (HOTS) has resulted in a paradigm shift from the conventional Teacher-centric practices of pedagogical design, delivery and assessment to the modern Learner-centric system to accomplish the stated outcomes. Learning can happen inside the classroom with the facilitation of the teacher, in collaboration with peers, and outside the classroom in industry or on the field. The continuous learning and achieving excellence can be accomplished only by the involvement of individuals, and more effectively in small groups of 4-5. The best example for individual learning as evidenced from time immemorial events was the sole-learning by young Hanuman from his great Guru/Teacher Lord Sun. Hanuman had involved in daily practice/demonstration as directed by his Teacher and eventually he became the Supreme Lord with profound knowledge, skill and strength. On the other hand, when learning happens in small or bigger groups/teams, then there will be a relative degree of learning and

**Corresponding Author: rvmgowda6@gmail.com*

Received: 15.06.2022 **Accepted:** 21.07.2022 **Published on**: 01.08.2022

consequently there is a variation in the level of knowledge and skill exhibited by each member in the group. So the precise measurement of individual's talent cannot be established by a small difference of few marks or few additional tasks accomplished by one with respect to another; instead a set of similar learners can be classified at the same level (category) as compared to other set of pupil who are relatively at higher/lower level(s)/categories of knowledge and skill. The best example for this is the categorization of great archers Arjuna, Eklavya and Karna at the same level. All the three had the similar skill/talent in archery with very little difference in strength or talent so that they were clubbed/graded in a single class/category of great archers. Similarly Bheema and Duryodhana had similar skill in Gadayudh. And Bheema, Jarasanda, Keechak and Duryodhana were almost equals in Mallayudh. The other Pandavas and Kauravas were inferior to Arjuna in archery and hence they were relatively weaker in that skill. These examples clearly envisage that there was a need for Grading of the Learners according to their similar level of knowledge/skill in one category and the others with varying levels of knowledge/skill in different categories relative to the first category.

With the advent of accreditation in higher education throughout the world and a systematic practice of continuous learning through Choice Based Credit System (CBCS) in premier institutions such IITs and autonomous institutions, greater emphasis is laid upon the ***'Grade System'*** in OBE as against the conventional ***'Marks System'***. So in recent years, Assessment / Examination play a vital role in deciding the level of learning and hence the overall quality of education. Owing to reforms in Examination system over a period of time, there is a considerable improvement in the academic quality of examinations in terms of preparing quality question papers and the method/mode of conducting assessment/examination, but the method of marking the answer scripts and grading the learners in Indian Engineering education system has been a matter of great concern for long time. In this context the Institutes of national importance and autonomous departments follow the Relative Grading system while many larger Universities and affiliated institutions with huge students' strength used to follow marks system or some sort of grading system. Therefore, the University Grants Commission (UGC) felt that it is necessary to introduce a uniform grading system, which will benefit the students to move across institutions both within India and across other countries in the globe. In order to bring the uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated guidelines in 2015 to follow a uniform grading known as Absolute Grading system with defined class interval of marks for each Letter Grade and Grade Point as described in Table 1.

Table 1 Letter Grades and Grade Points

Letter Grade and description	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

2. Comparison between Absolute Grading and Relative Grading

Premier autonomous institutions such as IITs/NITs have been following the Relative Grading system devised by the subject teachers/course coordinators from long time, However, many Universities such as Anna University and several Autonomous engineering institutions hitherto followed the Absolute Grading system recommended by UGC with the description of Grades ranging from 'O' to 'C' and corresponding Grade Points ranging from 10 to 5 as shown in Table 1. Recently Anna University and several Autonomous engineering colleges have introduced the Relative Grading system using software that generates grades once marks are input to it. There is a great deal of discussion about this new system amongst academics, students and parents. So the present paper brings out a detailed comparison between Absolute Grading system and Relative Grading system. Table 2 highlights general comparison between both the grading systems.

2.1 Absolute Grading system

It is a system of grading where letter grades are awarded to students based upon their marks falling in any of the predetermined class intervals of marks shown in Table 3. The Absolute Grading system largely followed by Anna University for non-autonomous institutions and many Autonomous Engineering Colleges in Regulations 2015, 2017, 2019, etc., is as follows:

Table 2 General Comparison between Absolute Grading and Relative Grading

Absolute Grading	Relative Grading
It is rigid and confined to fixed class interval of marks.	It is flexible and varying depending upon the subject teacher and the degree of ease/difficulty of the subject.
It is based upon the fixed class interval of marks ranging from a mere pass (50) to 100.	It will vary from subject to subject depending upon the maximum and minimum marks scored.
It is uniform for all subjects, disciplines and institutions through the country.	It will vary from subject to subject, discipline to discipline and institute to institute.
It is insensitive to the degree of difficulty or ease of subjects.	It can be tailor-made depending upon the degree of difficulty or ease of the subject.
It is uniform for all Learners, Subjects and Teachers. It may or may not promote competition within the class of learners as relative performance is not measured.	It is both Learner- and Teacher-centric. It promotes competition within the class of learners as relative performance is measured.
It treats all learners similarly and grades them only on the basis of marks scored fitting into fixed class intervals.	Teacher may adopt a flexible grading depending upon the maximum and minimum marks to suit the nature of learners and their level of skill.
Less chances for Teacher's misuse and unwanted interference.	Teacher may misuse it for their selfish gains or to punish the students at times.
Learners used to get better Grades in practical courses where the performance is generally good with marks higher than 70.	Some learners even with higher marks in the range of 70-80 may suffer with lower grades in practical courses and project work.
Computation is simple and straight-forward with fixed class interval of marks for each grade in any subject.	Computation needs a software or Excel to draw normal distribution curve for normalization of scores to determine the grades.
Less chances for bias or discrimination.	There are chances for bias or discrimination.
It is applicable to both small size and large size samples or population.	It is not applicable to small sample of size <30 but applicable to medium or large size samples.

Table 3 Absolute Grading system

Range of Marks	Letter Grade	Grade Point
91-100	O	10
81-90	A+	9
71-80	A	8
61-70	B+	7
57-60	B	6
50-56	C	5

2.2 Relative Grading

- It is a system of grading where a student's grade is determined in each subject by the concerned faculty member / subject teacher, taking into consideration on how that particular student performed in comparison to that of his/her classmates. The teacher used to decide the range of grades to be allotted to the students of his class based upon the maximum marks and minimum marks of the class.
- In this system, certain percentage of students with good performance will receive the highest grade "O" while some others with relatively poor performance will get the lowest grade "C" in every subject and the remaining ending up with intermediate grades.
    - In relative grading, the range of marks and subject teacher play a vital role, and students may receive grades in a given subject approximately as follows:
        - 5-10 % of students may get 'O' Grade
        - 20% of students may get 'A+' Grade
        - 30-35 % of students may get 'A' Grade
        - 20% of students may get 'B+' Grade
        - 10% of students may get 'B' Grade
        - 5-10% of students may get 'C' Grade

Table 4 depicts a classical comparison between the two methods of grading for few subjects.

Table 4 Classical comparison between Absolute Grading and Relative Grading

No. of Students in a Class	Name of the Subject	Marks scored by the Students	Absolute Grading As per UGC guidelines	Relative Grading suggested by AU and Autonomous Colleges
60	Physics Laboratory	91 – 100 marks	Every student with marks in the range of 91-100 will receive "O" Grade.	7-8 students will get 'O' Grade 12-13 students will get 'A+' Grade 15-16 students will get 'A' Grade 12-13 students will get 'B+' Grade 5-6 students may get 'B' Grade
60	English	71 – 100 marks	Every student with marks in the range of 91-100 will receive "O" Grade Every student with marks in the range of 81-90 will receive "A+" Grade Every student with marks in the range of 71-80 will receive "A" Grade	7-8 students will get 'O' Grade 12-13 students will get 'A+' Grade 15-16 students will get 'A' Grade 12-13 students will get 'B+' Grade 5-6 students will get 'B' Grade 0-5 students may get 'C' Grade
60	Mathematics	50-99 marks	Students will receive Grades based upon their marks falling in the class intervals as highlighted in Table 3	7-8 students will get 'O' Grade 12-13 students will get 'A+' Grade 15-16 students will get 'A' Grade 12-13 students will get 'B+' Grade 5-6 students will get 'B' Grade 5-6 students will get 'C' Grade
60	Digital Signal Processing	50-75 marks	Students will receive Grades ranging from 'C' to 'A' based upon their marks falling in the class intervals as highlighted in Table 3	No students will get 'O' Grade 0-5 students will get 'A+' Grade 15-16 students will get 'A' Grade 25-35 students will get 'B+' Grade 15-20 students will get 'B' Grade 5-10 students will get 'C' Grade

Table 5 Comparison of Absolute Grading and Relative Grading for a class of students

| S. No. | R. No. | Subject # 1 | | | | | | Subject # 2 | | | | | | Subject # 3 | | | | | | Subject # 4 | | | | | | Subject # 5 | | | | | | Subject # 6 | | | | | | Subject # 7 | | | | | | Subject # 8 | | | | | | Result | AG GPA | RG GPA | Diff. |
|---|---|---

| S. No. | R. No. | Subject # 1 | | | | | | Subject # 2 | | | | | | Subject # 3 | | | | | | Subject # 4 | | | | | | Subject # 5 | | | | | | Subject # 6 | | | | | | Subject # 7 | | | | | | Subject # 8 | | | | | | Result | AG GPA | RG GPA | Diff. |
|---|---|---

3. Detailed Analysis, Interpretation and Recommendations

It can be seen from Table 4 that in the subject Mathematics since the students have scored marks in the entire range from 50-99, the grades received by students by following any of the two grading systems will be almost similar. The similar will be the case in a difficult subject such as Digital Signal Processing where students scored marks ranging from 50 to 75 will receive grades from 'C' to 'A'. So there may not be any specific difference in the grades received by students in both the systems of grading. However in case of relatively easier subjects, namely English, Physics Laboratory and others, where students used to score higher range of marks from 70 to 100, there is a discernible difference in the grades received by the students using both methods. Especially those students who scored lower marks nearer to the lower range of marks, i.e. nearer to 91 in Physics Laboratory and 71-80 in English, So it is clear that in both subjects if Absolute Grading is followed the students will receive grades ranging from 'O' to 'A' whereas if a Relative Grading is followed as many as 30-35% students will receive grades below 'A' going upto 'C', which is a substantial loss for such students who will eventually end up in scoring lower GPA/CGPA. Especially, awarding grades 'C' or 'B' to students who used to score around 91-93 marks or even above 80 marks in Practical courses is a great injustice to such students. So Relative Grading is a big concern in easier subjects where almost all students used to score very high marks, perhaps more than 75% marks, and those with marks around 75-80 will end up in receiving lower grades such as 'B' or 'C' grades. In such cases it is recommended that a Dual/Twin Grading system might be followed, wherein Relative Grading can be used to grade the performance in Theory subjects which have the whole range of marks while Absolute Grading can be employed to grade relatively better performance in Practicals and such easier courses.

3.1 Analysis and Interpretation for Real-time Examples

Table 5 brings out a clearer and detailed comparative analysis between both the grading systems for a class of students with real-time data sets. It can be seen from Table 5 that there is a significant difference in GPA obtained by the students using Absolute Grading and Relative Grading. The reduction in GPA due to Relative Grading as against Absolute Grading for students in a semester varies from 0.14 to 0.73 with an average loss of 0.42. So if similar differences are considered over a period of 8 semesters of Engineering degree, then the reduction in CGPA will be ranging from 0.4 to 1.0, which is a huge loss to some students.

Hence there is a great need to normalize the negative effect of Relative Grading. The subject teachers, instead of randomly determining the range of marks and grades to be awarded based upon random class intervals and clustering of marks, shall use normal distribution of marks scored by students in each subject and then work out suitable ranges of marks based upon ±σ limits on both sides of the central mean (class average) for normalization to choose appropriate class intervals and hence allot suitable grades relatively.

In the present study the authors have used MS Excel and computed the average (Mean), standard deviation (STD) and normal distribution values for the data given in Table 5 for all eight subjects. The normal distribution curve is generated for each subject and the set of such curves for all 8 subjects are shown in Figures 1-8.

Figures 1-9 show the plot of normal distribution values versus marks in each subject. It can be observed that Figures 1, 3 & 4 are not symmetrical but skewed to right. However, Figures 2, 5, 6 & 7 are almost symmetrical. Figures 8 & 9 are not symmetrical but skewed to left. It can be inferred that if the distribution curves are normal or almost symmetrical then the software based upon the Normal/Gaussian distribution can be readily used to grade the performance based upon the marks scored by the class of students. However, if the curves are not normal, then there is a need for normalization of the scores and accordingly allot the grades. In all cases, it is better to calculate the mean (class average), standard deviation, normal distribution values and plot the curve for each subject to examine its nature. It is advisable to compute class intervals of marks in terms of μ±σ limits and accordingly make suitable classes/categories to award grades and grade points.

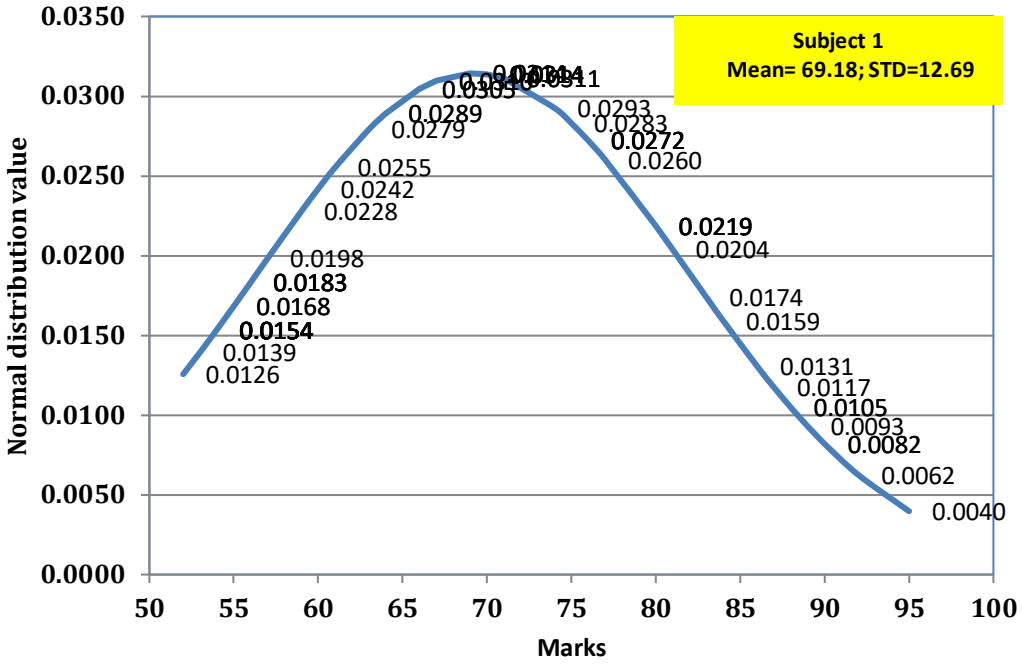

Fig. 1 Normal distribution curve for Marks in Subject 1 (skewed to right)

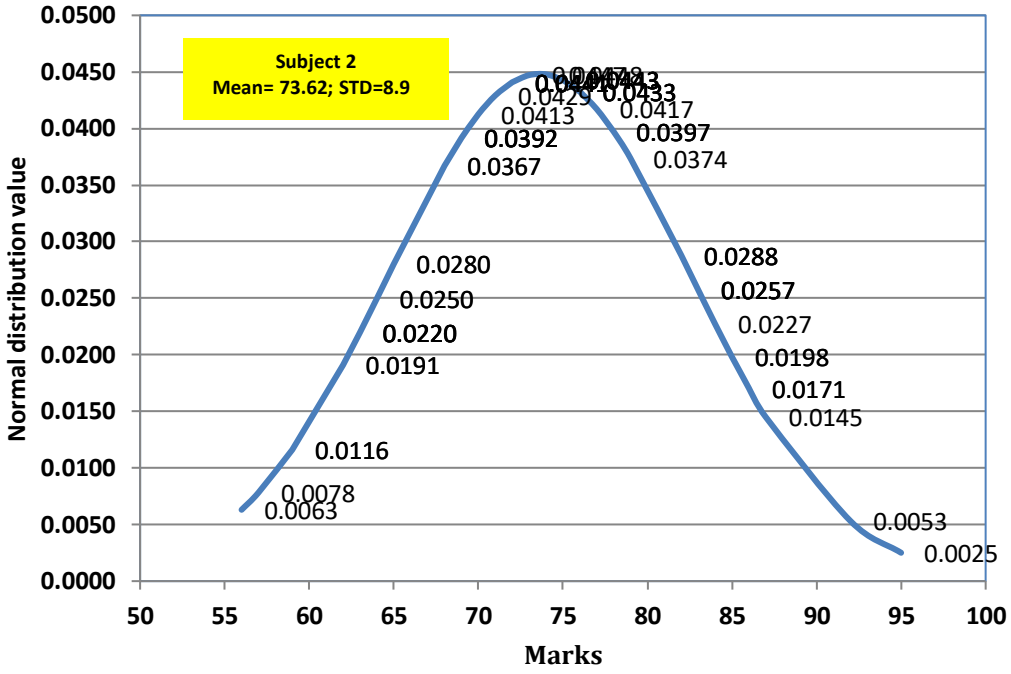

Fig. 2 Normal distribution curve for Marks in Subject 2 (Almost symmetrical)

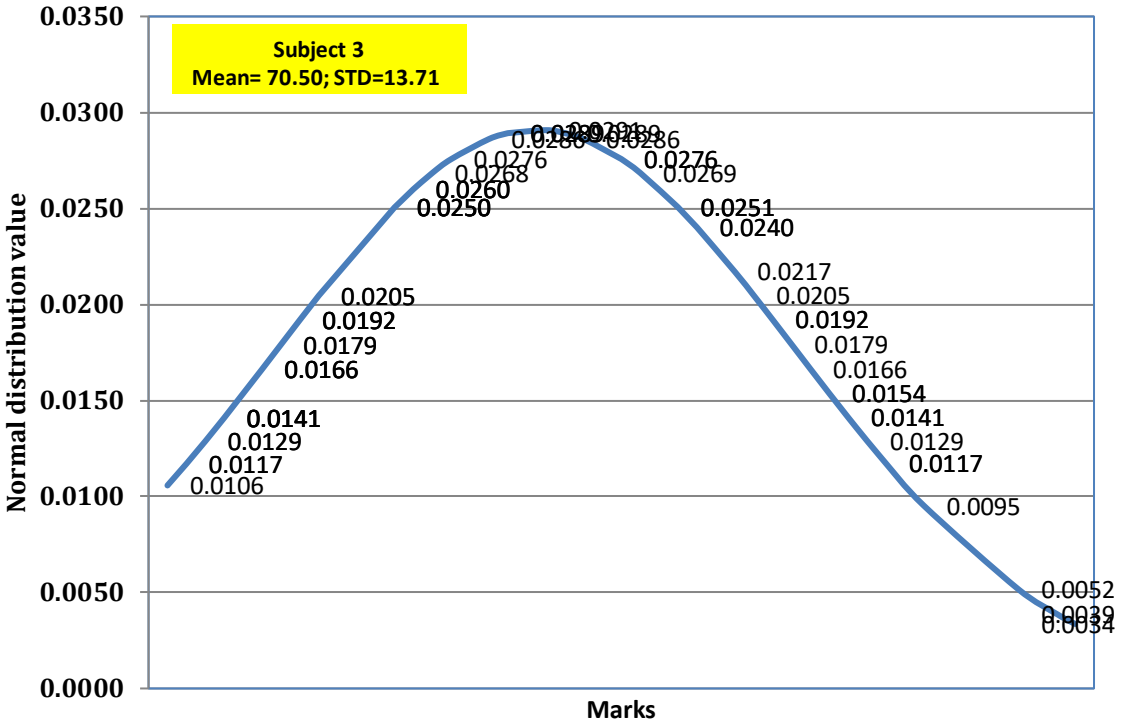

Fig. 3 Normal distribution curve for Marks in Subject 3 (skewed to right)

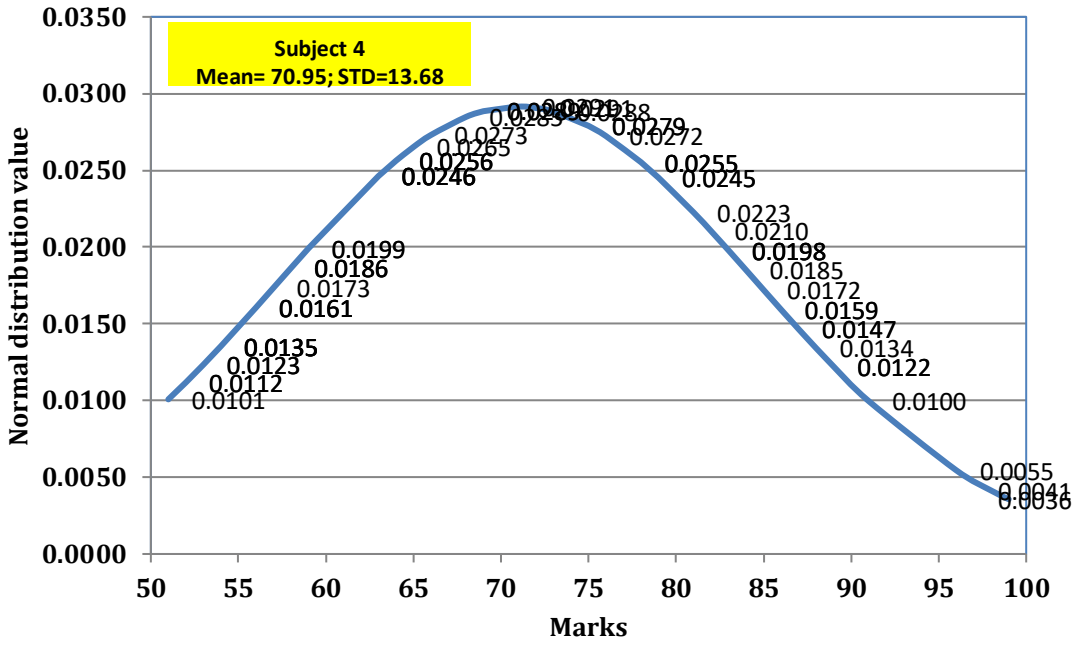

Fig. 4 Normal distribution curve for Marks in Subject 4 (skewed to right)

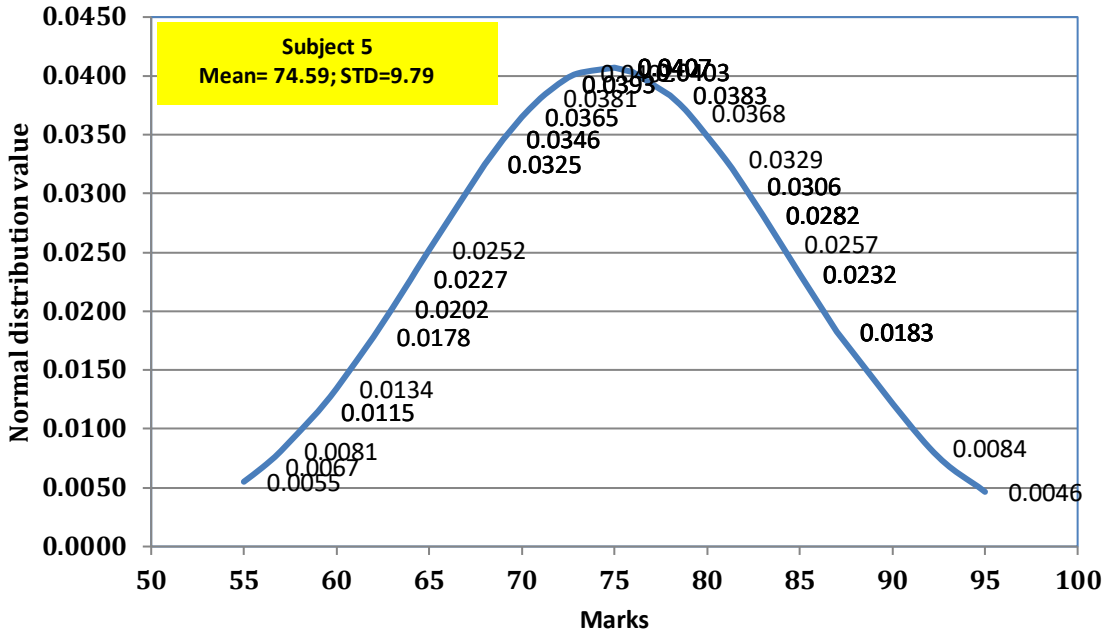

Fig. 5 Normal distribution curve for Marks in Subject 5 (Almost symmetrical)

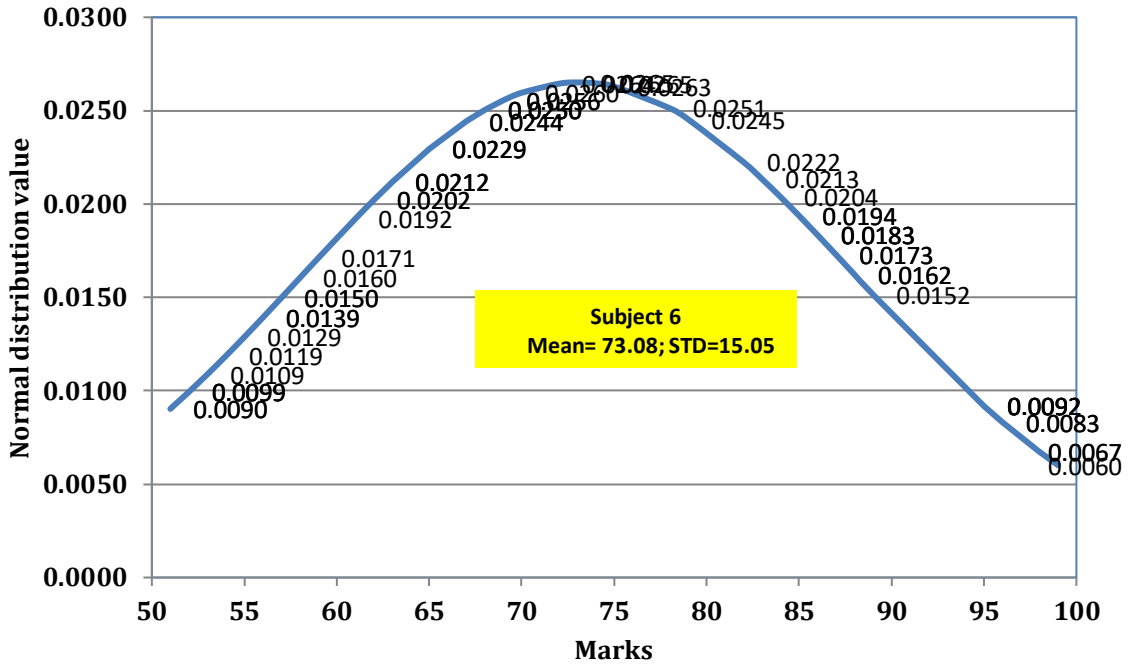

Fig. 6 Normal distribution curve for Marks in Subject 6 (Almost symmetrical)

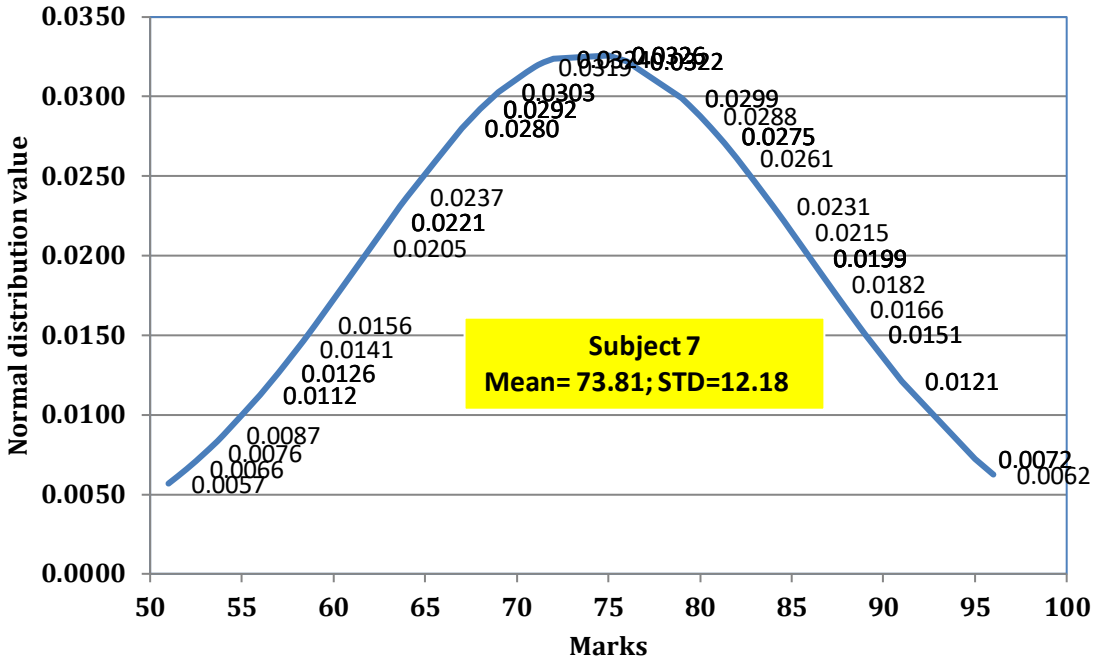

Fig. 7 Normal distribution curve for Marks in Subject 7 (Almost symmetrical)

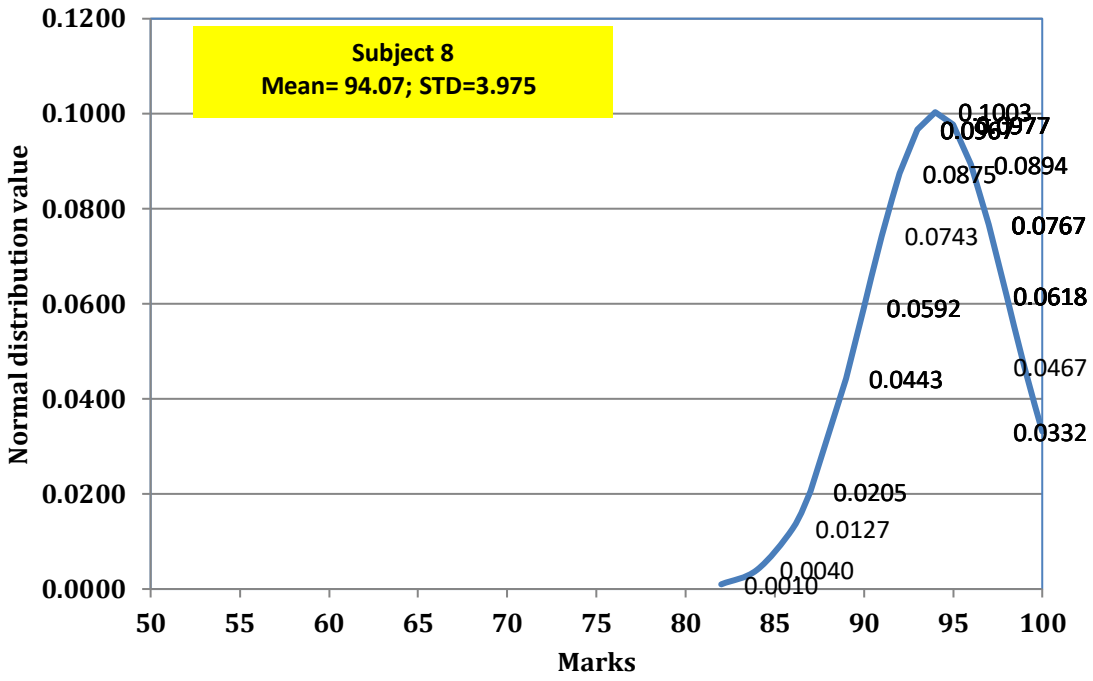

Fig. 8 Normal distribution curve for Marks in Subject 8 (skewed to left)

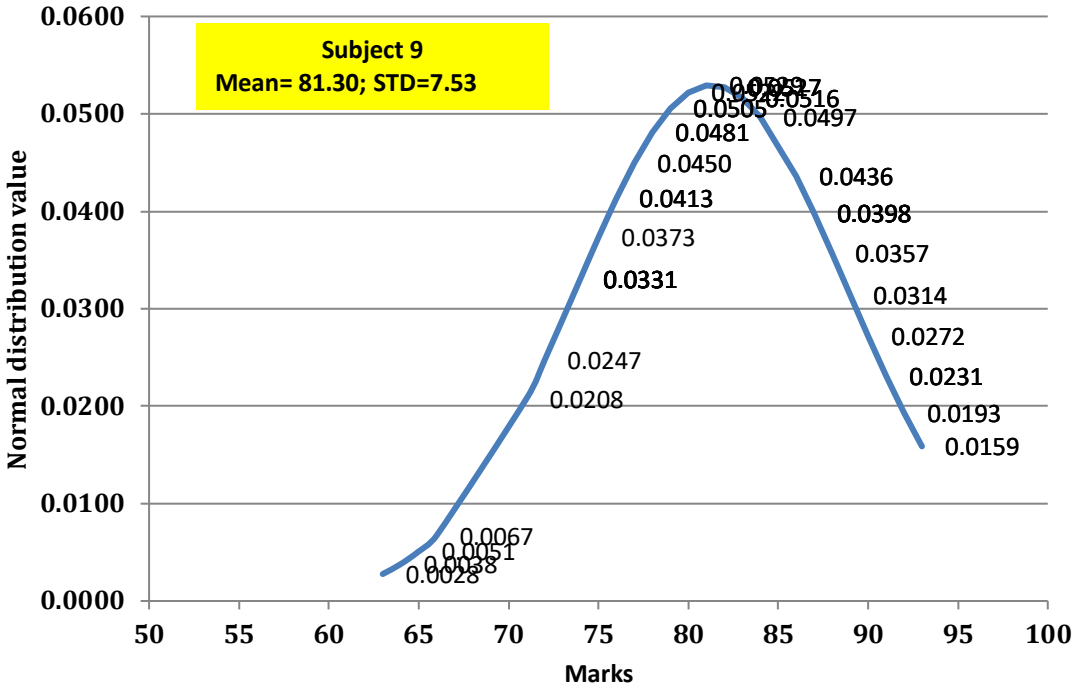

Fig. 9 Normal distribution curve for Marks in Subject 9 (skewed to left)

3.2 Analysis and Interpretation for Classical/Ideal cases

In order to carry out a detailed analysis it is better to assume the following 3 classical/ideal or most common cases/categories, wherein the students used to score: (i) marks ranging from a mere pass (50) to full marks (100) as highlighted in Table 6; (ii) marks ranging from 50 to 80 (Table 7) assuming that the subject is relatively difficult; and (iii) marks ranging from 70 to 100 (Table 8), assuming the particular subject is relatively easy. The authors have carried out a detailed analysis of the data given in Tables 6-8 and, for each case, calculated the mean, standard deviation, normal distribution values, and drawn the normal distribution curves as shown in Figures 10-12. The $\mu \pm \sigma$ Limits are computed and accordingly recommended/suggested possible Class Intervals with appropriate Grades in all three cases.

Table 6 Classical/Ideal Case-1 Data Analysis

Marks/ Scores (x)	Standard Grade Point (y_1)	Actual Grade Point (y_2)	Normal distribution value (z)	Relative Grade suggested	Absolute Grade as expected
50	5.0	5	0.0002	C	C
51	5.1	5	0.0003	C	C
52	5.2	5	0.0005	C	C
53	5.3	5	0.0007	C	C
54	5.4	5	0.0011	C	C
55	5.5	5	0.0015	C	C
56	5.6	6	0.0021	C	B
57	5.7	6	0.0030	C	B
58	5.8	6	0.0041	C	B
59	5.9	6	0.0055	C	B
60	6.0	6	0.0072	C	B

61	6.1	7	0.0093	B	B+
62	6.2	7	0.0118	B	B+
63	6.3	7	0.0148	B	B+
64	6.4	7	0.0181	B	B+
65	6.5	7	0.0219	B	B+
66	6.6	7	0.0259	B	B+
67	6.7	7	0.0301	B	B+
68	6.8	7	0.0344	B	B+
69	6.9	7	0.0386	B+	B+
70	7.0	7	0.0426	B+	B+
71	7.1	8	0.0461	B+	A
72	7.2	8	0.0491	B+	A
73	7.3	8	0.0513	B+	A
74	7.4	8	0.0527	B+	A
75	7.5	8	0.0532	B+	A
76	7.6	8	0.0527	A	A
77	7.7	8	0.0513	A	A
78	7.8	8	0.0491	A	A
79	7.9	8	0.0461	A	A
80	8.0	8	0.0426	A	A
81	8.1	9	0.0386	A	A+
82	8.2	9	0.0344	A	A+
83	8.3	9	0.0301	A+	A+
84	8.4	9	0.0259	A+	A+
85	8.5	9	0.0219	A+	A+
86	8.6	9	0.0181	A+	A+
87	8.7	9	0.0148	A+	A+
88	8.8	9	0.0118	A+	A+
89	8.9	9	0.0093	A+	A+
90	9.0	9	0.0072	A+	A+
91	9.1	10	0.0055	O	O
92	9.2	10	0.0041	O	O
93	9.3	10	0.0030	O	O
94	9.4	10	0.0021	O	O
95	9.5	10	0.0015	O	O
96	9.6	10	0.0011	O	O
97	9.7	10	0.0007	O	O
98	9.8	10	0.0005	O	O
99	9.9	10	0.0003	O	O
100	10.0	10	0.0002	O	O
μ = 75.0	**μ = 7.50**	**μ = 7.84**			
σ = 14.87	**σ = 1.49**	**σ = 1.63**			
μ ± σ Limits	-2.0 σ = 45.27 ; -1.5 σ = 52.70 ; -1.0 σ = 60.13 -0.5 σ = 67.57 ; μ = 75.0 ; 0.5 σ = 82.43 1.0 σ = 89.87 ; 1.5 σ = 97.30 ; 2.0 σ = 104.73				
Suggested Class Intervals	LL	to	UL	Range	Grade
	1.0 σ	to	>1.5 σ	91 to 100	O

and Grades		0.5 σ	to	1.0 σ	83 to 90	A+		
		μ	to	0.5 σ	76 to 82	A		
		-0.5 σ	to	μ	69 to 75	B+		
		-1.0 σ	to	-0.5 σ	61 to 68	B		
		<-1.5 σ	to	-1.0 σ	50 to 60	C		

It can be observed from Table 6 that there are slight differences in the Relative Grades suggested in this study as against the expected Absolute Grades. Such small differences in Grades will not lead to any significant difference in the GPA of learners or average GPA of the class.

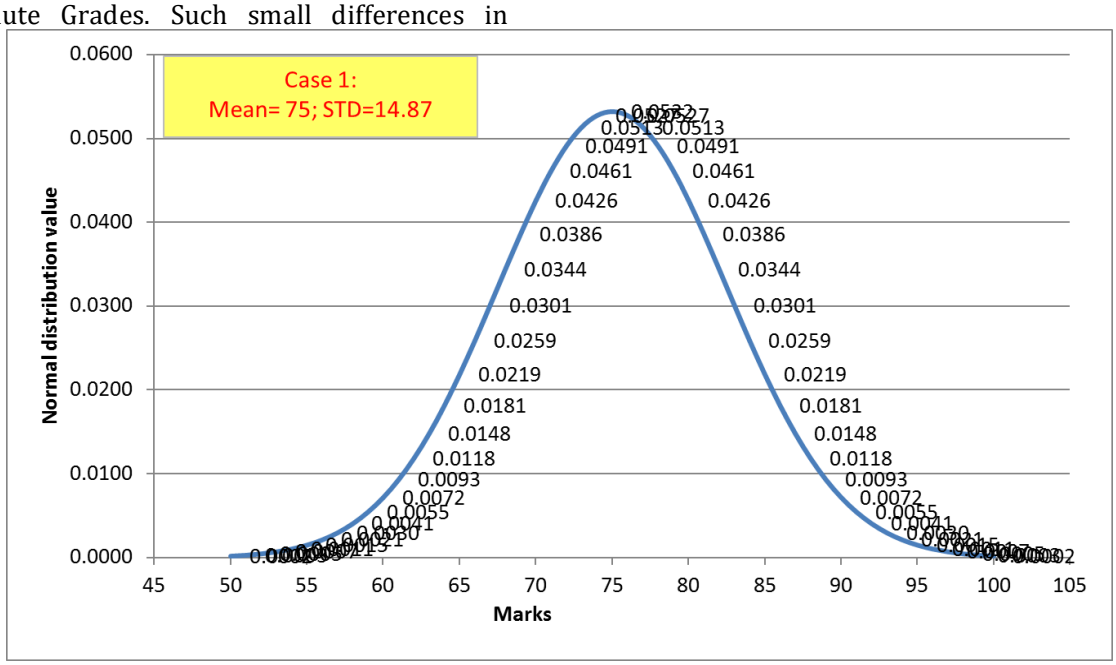

Fig. 10 Normal distribution curve for Marks in Ideal Case 1

Table 7 Classical/Ideal Case-2 Data Analysis

Marks/ Scores (x)	Standard Grade Point (y_1)	Actual Grade Point (y_2)	Normal distribution value (z)	Relative Grade suggested	Absolute Grade as expected
50	5.0	5	0.0113	C	C
51	5.1	5	0.0134	C	C
52	5.2	5	0.0158	C	C
53	5.3	5	0.0184	C	C
54	5.4	5	0.0211	C	C
55	5.5	5	0.0240	C	C
56	5.6	6	0.0269	B	B
57	5.7	6	0.0298	B	B
58	5.8	6	0.0326	B	B
59	5.9	6	0.0353	B	B
60	6.0	6	0.0377	B	B
61	6.1	7	0.0398	B+	B+
62	6.2	7	0.0416	B+	B+

63	6.3	7	0.0428	B+	B+
64	6.4	7	0.0436	B+	B+
65	6.5	7	0.0439	B+	B+
66	6.6	7	0.0436	B+	B+
67	6.7	7	0.0428	B+	B+
68	6.8	7	0.0416	B+	B+
69	6.9	7	0.0398	B+	B+
70	7.0	7	0.0377	B+	B+
71	7.1	8	0.0353	A	A
72	7.2	8	0.0326	A	A
73	7.3	8	0.0298	A	A
74	7.4	8	0.0269	A	A
75	7.5	8	0.0240	A+	A
76	7.6	8	0.0211	A+	A
77	7.7	8	0.0184	A+	A
78	7.8	8	0.0158	A+	A
79	7.9	8	0.0134	A+	A
80	8.0	8	0.0113	A+	A
μ = 65.0	**μ = 6.50**	**μ = 6.77**			
σ = 9.09	**σ = 0.91**	**σ = 1.12**			
μ ± σ Limits	-2.0 σ = 46.82 ; -1.5 σ = 51.37 ; -1.0 σ = 55.91 -0.5 σ = 60.49 ; μ = 65.0 ; 0.5 σ = 69.55 1.0 σ = 74.09 ; 1.5 σ = 78.64 ; 2.0 σ = 83.18				

Suggested Class Intervals and Grades

LL	to	UL	Range	Grade
1.0 σ	to	>1.5 σ	75 to 80	A+
0.5 σ	to	1.0 σ	71 to 74	A
-0.5 σ	to	0.5 σ	61 to 70	B+
-1.0 σ	to	-0.5 σ	56 to 60	B
-1.5 σ	to	-1.0 σ	50 to 55	C

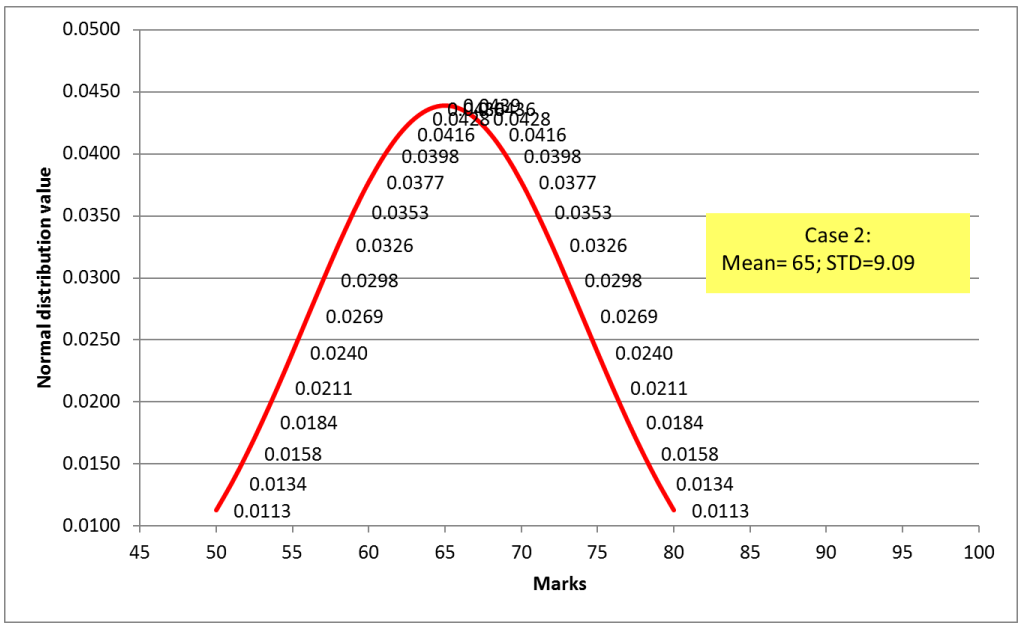

Fig. 11 Normal distribution curve for Marks in Ideal Case 2

Table 7 reveals a good match between the Relative Grades suggested in this study and the expected Absolute Grades. Moreover, the suggested Relative grading method for a subject perceived to be difficult will help some students with marks from 75 to 80 to secure a higher grade such as A+ instead of A. Again this minor difference will not lead to any significant difference in the GPA of learners or average GPA of the class. So the suggested Relative Grading system, without any negative effect on the GPA/CGPA of learners, is almost similar to the Absolute Grading system.

Table 8 Classical/Ideal Case 3 Data Analysis

Marks/ Scores (x)	Standard Grade Point (y_1)	Actual Grade Point (y_2)	Normal distribution value (z)	Relative Grade suggested	Absolute Grade as expected
70	7.0	7	0.0113	B+	B+
71	7.1	8	0.0134	B+	A
72	7.2	8	0.0158	B+	A
73	7.3	8	0.0184	B+	A
74	7.4	8	0.0211	B+	A
75	7.5	8	0.0240	B+	A
76	7.6	8	0.0269	A	A
77	7.7	8	0.0298	A	A
78	7.8	8	0.0326	A	A
79	7.9	8	0.0353	A	A
80	8.0	8	0.0377	A	A
81	8.1	9	0.0398	A+	A+
82	8.2	9	0.0416	A+	A+
83	8.3	9	0.0428	A+	A+
84	8.4	9	0.0436	A+	A+
85	8.5	9	0.0439	A+	A+
86	8.6	9	0.0436	A+	A+
87	8.7	9	0.0428	A+	A+
88	8.8	9	0.0416	A+	A+
89	8.9	9	0.0398	A+	A+
90	9.0	9	0.0377	A+	A+
91	9.1	10	0.0353	O	O
92	9.2	10	0.0326	O	O
93	9.3	10	0.0298	O	O
94	9.4	10	0.0269	O	O
95	9.5	10	0.0240	O	O
96	9.6	10	0.0211	O	O
97	9.7	10	0.0184	O	O
98	9.8	10	0.0158	O	O
99	9.9	10	0.0134	O	O
100	10.0	10	0.0113	O	O
μ = 85.0	**μ = 8.50**	**μ = 8.94**			
σ = 9.09	**σ = 0.91**	**σ = 0.89**			
$\mu \pm \sigma$ Limits	-1.5 σ = 71.37 ; -1.0 σ = 75.91 -0.5 σ = 80.46 ; μ = 85.0 ; 0.5 σ = 89.55 1.0 σ = 94.09 ; 1.5 σ = 98.64 ; 2.0 σ =103.18				

Suggested Class Intervals and Grades	LL	to	UL	Range	Grade
	0.5 σ	to	>1.5 σ	91 to 100	O
	-0.5 σ	to	0.5 σ	81 to 90	A+
	-1.0 σ	to	-0.5 σ	76 to 80	A
	< -1.5 σ	to	-1.0 σ	70 to 75	B+

Table 8 also depicts a good match between the Relative Grades suggested in this study and the expected Absolute Grades. Of course the suggested grading method awards 'B+' grade to 6 students as against only one student securing 'B+' grade in absolute grading system. Such small differences in Relative Grades suggested by the authors will not have any deteriorating effect on the GPA of the learner or the average GPA of the class.

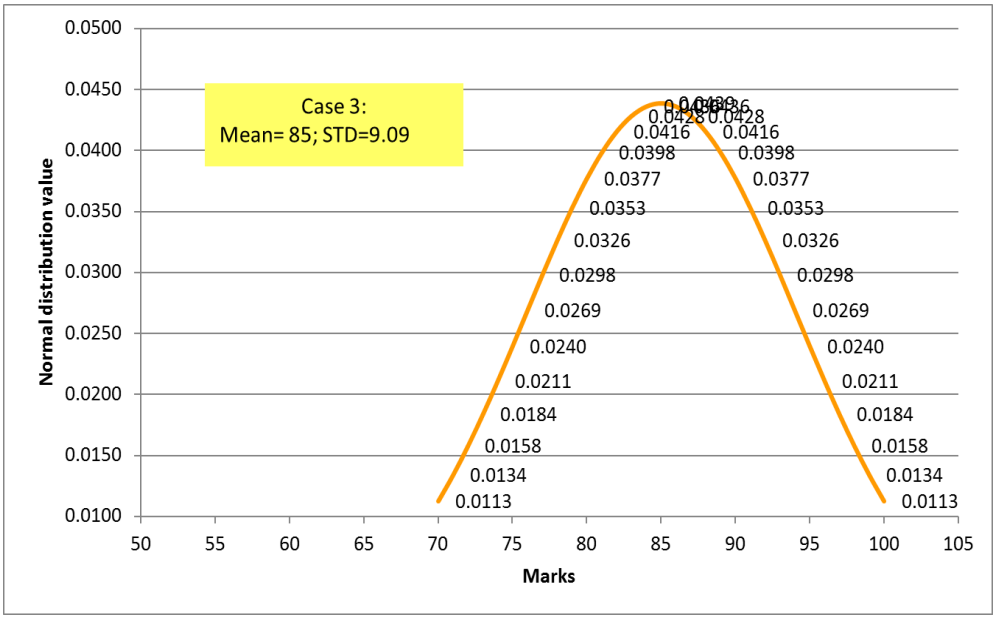

Fig. 12 Normal distribution curve for Marks in Ideal Case 3

Table 9 Recommended Table of Conversion

Marks	GPA		GPA	Marks
45	5.00		5.00	45
50	5.50		5.50	50
55	6.05		6.00	55
60	**6.60**		6.50	59
65	7.15		**6.60**	**60**
70	7.70		6.75	61
75	8.25		7.00	64
77	**8.50**		7.50	68
80	8.80		8.00	73
85	9.35		**8.50**	**77**
90	9.90		9.00	82
91	10.0		9.50	86
95	max 10		10.0	91
100	max 10		10.0	91-100

4. Relationship between Grade Point, Grade Point Average and Marks

In any evaluation or assessment, marks are primarily awarded to the learners. Marks are in turn related to the Letter Grades, Grade Points and eventually Grade Point Average (GPA) or Cumulative Grade Point Average (CGPA) is calculated. Different grading systems follow different class intervals of marks and corresponding Grades and Grade points, resulting in calculation of GPA or CGPA accordingly.

Hence there is some difference in the relationship between Marks and GPA (CGPA) as proposed by AICTE, UGC and other Universities and Institutions. Even there is a difference in GPA/CGPA calculation between the Absolute Grading system and Relative Grading system as clearly explained by the authors in Section 3.

So it is becoming very important to properly relate the Marks to the Grade Point (GP). The authors have attempted to relate the Marks and Grade points in all three ideal cases assumed in Section 3.2. In each case the Standard Grade Points (y_1) and Actual Grade Points (y_2) are plotted against Marks (x) and the regression equations are derived with the coefficient of determination (R^2). Figures 13-15 show the relationship between GP and Marks in all three ideal cases. The R^2 values ranging from 0.9 to 1.0 in all the three cases show that there is a strong linear relationship between GP and Marks.

Upon analysis of the relationship between y_2 and x in all three cases, it is normalized that **y_2=0.11*x, i.e. Actual Grade Point = 0.11 x Marks**. If the same logic is extended and on similar computation one can relate that, **on a 10-point scale, CGPA = 0.11 x Marks. In other words Marks = 9.09 x CGPA on 10-point scale. So 60-Marks out of 100 is equivalent to a CGPA of 6.60 on a 10-point scale, resulting in the First Class degree. Similarly 77-Marks out of 100 is equivalent to 8.50 on a 10-point scale, resulting in First Class with Distinction**.

So the conversion of Marks into GPA (CGPA) and GPA (CGPA) into Marks is computed as given in Table 9 and it is recommended for use and implementation by the Institutions, Teachers and Students.

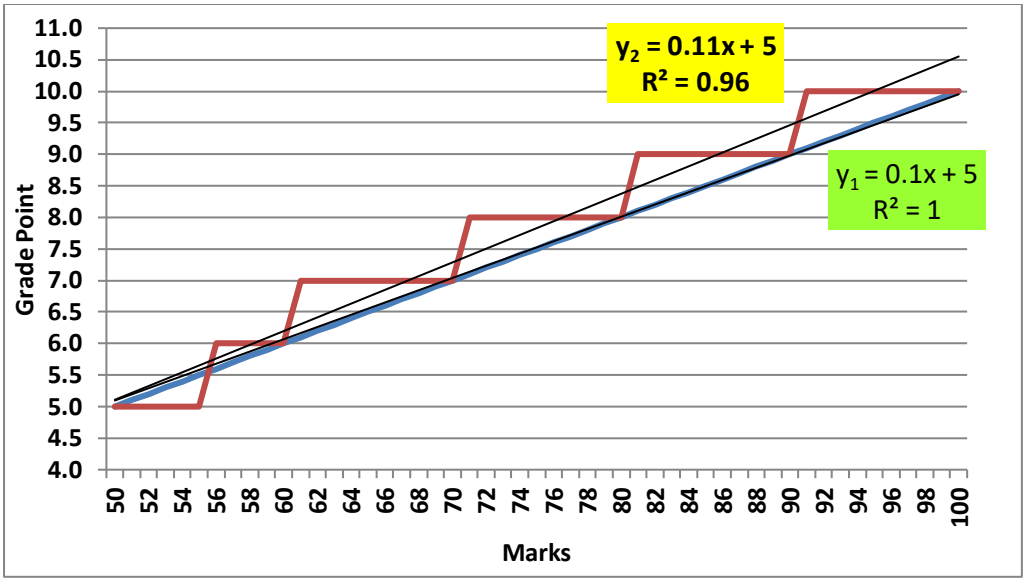

Fig. 13 Graph for Ideal Case-1

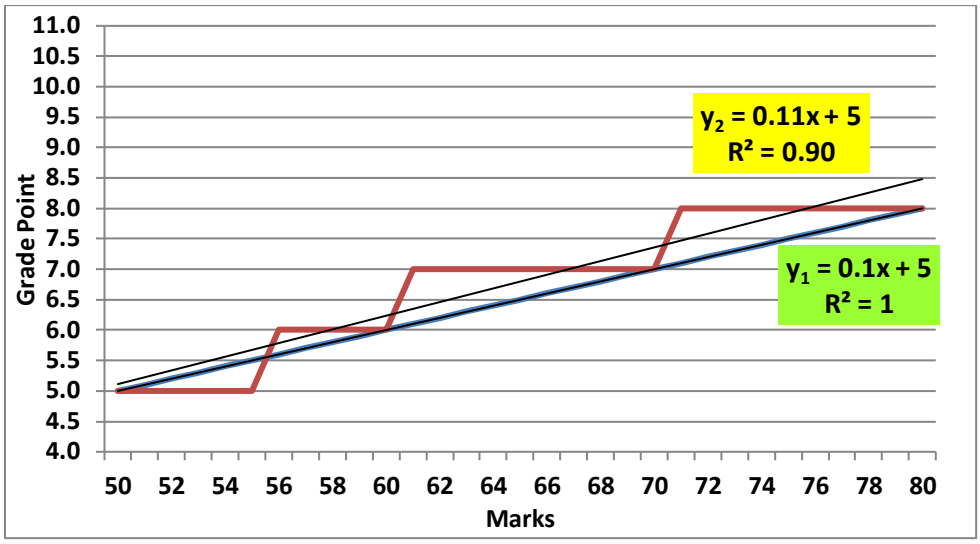

Fig. 14 Graph for Ideal Case-2

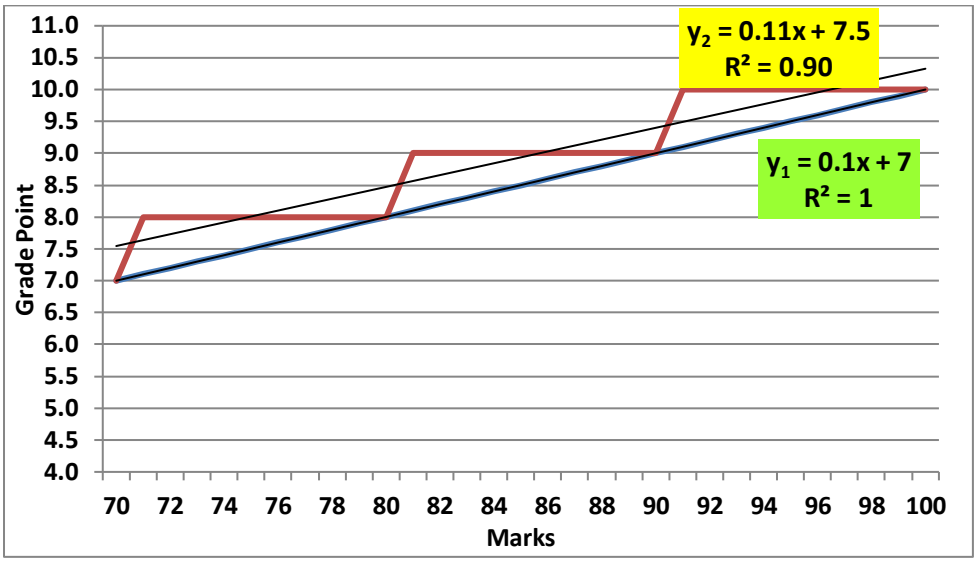

Fig. 15 Graph for Ideal Case-3

5. CONCLUSIONS AND RECOMMENDATIONS

Based upon the above detailed research and analysis the following conclusions are drawn and suitable recommendations are made for practice and implementation:

- Relative grading system fails to showcase the exact/accurate performance of a student as his/her performance is linked to the performance of other students of a class.
- However it helps to bring out competition within a class for improving the relative performance amongst learners.
- More number of average and below average students who score relatively lower range of marks are bound to receive relatively lower grades and hence they may end up with securing lower GPA/CGPA.
- The Relative Grading system with a normalization effect through computing $\mu \pm \sigma$ limits and adopting suitable class intervals of marks to allot appropriate grades as suggested by the authors in the present study minimizes the difference

between the grades received by students as compared to those received by following the Absolute Grading system.

- It is strongly recommended to use the essence of this research and analysis for application by various stakeholders to compute appropriate grades for the learners without any negative effect on GPA/CGPA or average GPA of the class.
- It is even recommended that a Dual/Twin Grading system might be followed wherein the Relative Grading can be used to grade the performance in Theory subjects while Absolute Grading can be employed to grade relatively better performance in Practicals and such easier courses.
- There is a strong linear relationship between GP and Marks. Upon normalization it is found that Actual Grade Point = 0.11 x Marks. The authors recommend using Table 9 as a ready-reckoner for conversion of Marks into GPA/CGPA or vice-versa.

All © 2022 are reserved by International Journal of Advanced Science and Engineering. This Journal is licensed under a Creative Commons Attribution-Non Commercial-ShareAlike 3.0 Unported License.